Supp Ex. 10,12
Ch2 Conc Q. 13
Ch 2 Probs 18, 21, 49a, 55, 68

$$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

14/15

5 P.M Friday 10:00 AM PHYS 131 Taylor Larrechea

Ch2. Concept Questions

13 A.) Immediately after being released it is greater than g, but immediately gets taken back to 9.8 m/s.

B.) Just before hitting the water it is g ~~acceleration~~ equal to 9.8 m/s.

Ch 2. Problems

18 Porsche Honda 400m

3.5 m/s² 3.0 m/s²

1.0 s

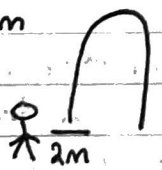
114.286(s) 133.333(s) -1.0(s)

Time ↑ Time ↑

The porsche gets there first by .18 seconds

21 Speed = 15 m/s

P = 2.0 m



$V_{iS} = 15$ $a = -g$ $-9.8\ m/s^2$

$S_i = 2.0$

$S_f = 0$

$S_f = S_i + V_{iS}\Delta t + \frac{1}{2}a_S(\Delta t)^2$

$0 = 2.0 + 15\Delta t - 4.9(\Delta t)^2$

$\frac{-15 \pm \sqrt{15^2 - 4(2)(-4.9)}}{2(-4.9)}$

-0.127983

$t = 3.19$ seconds

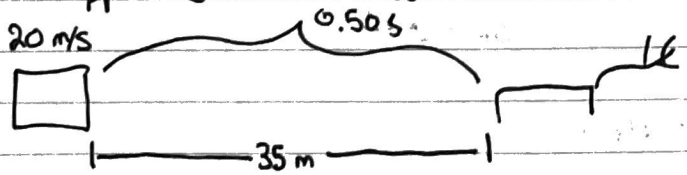
3/3

$S_f = 0 + 20(2) - 5(2)$

$S_f = 0 + 40 - 10$

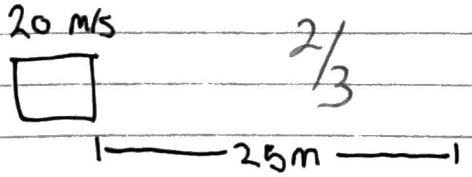
$S_f = 30$

49 a.) Stopped 5m after deer



$\frac{0.5}{2.0} = .10$

$S_f = S_i + V_S\Delta t$



2/3

$V_{fS} = V_{iS} + a_S\Delta t$

$0 = 20 + (-10)\Delta t$

$-20 = -10\Delta t$

$\Delta t = 2$ sec

$\Delta S = V_S\Delta t$ not if it has non-zero acceleration (-1)

$\Delta S = 20(0.5)$

$\Delta S = 10$

55 $m = 200$ kg $F = 100$ kg $a = 30$ m/s² for 30 s

$S_f = S_i + v_s \Delta t + \frac{1}{2} a_g (\Delta t)^2$

$S_f = 0 + 0(30) + \frac{1}{2}(30)(30)^2$

$S_f = 15(900)$

$S_f = 13{,}500$ m (runs out of fuel)

$v_{fs}^2 = v_{is}^2 + 2a\Delta s$

$v_{fs}^2 = 0^2 + 2(30)(13{,}500)$

$x^2 = 60(13{,}500)$

$v_f = 900$ m/s

$v_f^2 = v_i^2 + 2a\Delta s$

$0^2 = (900)^2 + 2(-9.8)\Delta s$

$0 = 810{,}000 - 19.6\Delta s$

$-810{,}000 = -19.6\Delta s$

$\Delta s = 41{,}326.5$

$S_f - 13{,}500 = 41{,}326.5$

$S_f = 54{,}826.5$ meters

A.) Maximum altitude 54.8 km

$V_i = 900$ m/s $V_f = ?$ $a = -9.8$ m/s² $S_i = 13{,}500$ m $S_f = 0$

$0 = 13{,}500 + 900\Delta t + -4.9(\Delta t)^2$

$0 = -4.9\Delta t^2 + 900\Delta t + 13{,}500$

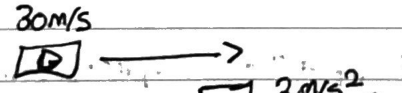
$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$\frac{-900 \pm \sqrt{900^2 - 4(-4.9)(13{,}500)}}{2(-4.9)}$

197.615

B.) Rocket is in air for 228 s

68



$S_f = S_i + v_i \Delta t$

$S_f = 0 + 30\Delta t$

$S_f = S_i + v_i \Delta t + \frac{1}{2} a (\Delta t)^2$

$S_f = 0 + 0\Delta t + 1\Delta t^2$

$S_f = \Delta t^2$

David $S_f = 0 + 30\Delta t$

Tina $S_f = \Delta t^2$

$30\Delta t = \Delta t^2$

$30 = \Delta t$

a.) $900\text{m} = S_f$

$\Delta t = 30$ $\Delta t^2 = 30^2$ $30^2 = 900$

b.) $v_f = v_i + a_g \Delta t$

$V_f = 0 + 2(30)$

$V_f = 60$ m/s

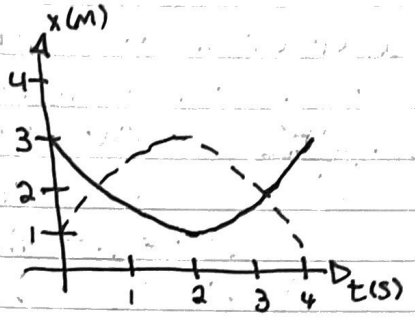
Supplementary Exercises

10

Ant (v)

Acceleration is first negative and then positive.

You're thinking about velocity.



Bug (iv)

Acceleration is first positive and then negative.

check solution

12 a.) The mans velocity changes from negative to positive in the time interval 2.0s to 3.0s. The man is slowing down in the negative direction where he flips his direction from negative to positive starting at $t = 2.5$ s. From 2.5s to 3.0s he is heading in the positive direction.

b.) The mans velocity at 2.0s is -1 m/s where his velocity at 3.0s is 1 m/s. The man flips his direction from the negative to the positive at 2.5s. That is why at 2.0s the velocity is negative and positive at 3.0s.

These two letters are switched

C.) The mans speed at 2.0s and 3.0s is 1 m/s because Speed is the absolute value of velocity.

$v_{2.0s} = -1$ m/s $\quad v_{3.0s} = 1$ m/s

$|v_{2.0s}| = 1$ m/s $\quad |v_{3.0s}| = 1$ m/s

D.)

Average Acceleration $= \frac{\Delta v}{\Delta t}$

$\Delta t = 3 - 2$

$\Delta t = 1$

The acceleration on the interval will be positive because it is a constant acceleration.

$v_1 = 1$ m/s $\quad t_1 = 3$

$v_0 = -1$ m/s $\quad t_0 = 2$

$\Delta v = v_1 - v_0$ $\quad \Delta v = (1 - (-1))$

$\Delta t = t_1 - t_0$ $\quad \Delta v = (1 + 1)$

$\frac{\Delta v}{\Delta t} \times \frac{2}{1}$ $\quad \Delta v = 2$

$a = 2$ m/s^2

e.) The acceleration does not vary during this interval or the entire interval because it is constant acceleration.

F.) $a = \frac{\Delta v}{\Delta t}$ $\quad \Delta v = (v_1 - v_0)$ $\quad v_0 = -1\,m/s$ $\quad v_1 = 1\,m/s$

$\Delta t = (t_1 - t_0)$ $\quad t_0 = 2$ $\quad t_1 = 3$

$$\frac{\Delta v = (1-(-1))}{\Delta t = (3-2)} = \frac{\Delta v\,(2)}{\Delta t\,(1)} = \frac{\Delta v}{\Delta t} = 2\,m/s^2$$

$a = 2\ m/s^2$

11 Non-freely falling object

A bungee jumper falls downward stretching the cord, reaching a low point, after which the cord pulls him up again. His velocity is recorded at equally spaced intervals in time. The data is:

Time in s	Velocity in m/s
10.0	−20.0
10.5	−15.0
11.0	−10.0
11.5	−5.0
12.0	0.0
12.5	5.0
13.0	10.0
13.5	15.0
14.0	20.0

a) During which period is the man falling? When is he rising?

b) By how much does the man's velocity change per second? Is this change constant throughout the recorded motion?

c) Determine the man's acceleration while he is falling and also while he is rising. Are these accelerations the same or not?

d) What is the man's acceleration (according to the data) at his low point?

12 Moving man

Go to the moving man animation at:

`http://phet.colorado.edu/en/simulation/moving-man`

Run the moving man animation. Click on the charts tab. Set the position to 0.00 m, the velocity to −5.00 m/s and the acceleration to 2.00 m/s^2. Run the animation, stopping it just before the man hits the wall. The animation will have recorded the motion. Check the playback button at the bottom. You can slide the light blue bar left and right to get data for the motion. Gray zoom icons at the right will let you rescale the charts.

a) Consider the interval from 2.0 s to 3.0 s. Describe the motion verbally during this time.

b) How does the speed of the man at 2.0 s compare to that at 3.0 s? Explain your answer.

c) How does the velocity of the man at 2.0 s compare to that at 3.0 s? Explain your answer.

d) Will the average acceleration over the interval from 2.0 s to 3.0 s be positive, negative or zero? Explain your answer.

e) If the acceleration is not zero, does it vary during this interval? Explain your answer.

f) Determine the average acceleration over the interval from 2.0 s to 3.0 s.

Supp, 9,11
Ch 2. Conc Q. 11
Ch 2. Probs. 9,12,38

Supp, 10,12
Ch 2. Conc. Q. 13
Ch 2. Probs 18,21,49a, 55, 68

9 Acceleration sign

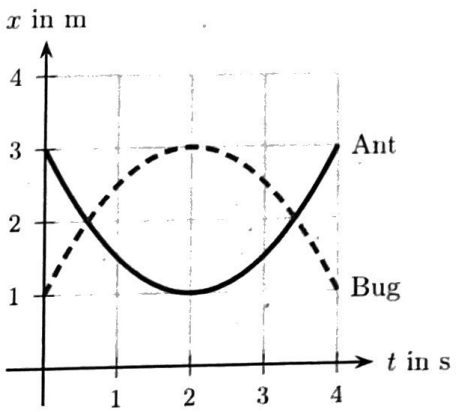
A bicycle can move east (positive) or west (negative).

a) If the bicycle moves east can the acceleration be negative? Explain your answer.

b) If the bicycle moves west can the acceleration be positive? Explain your answer.

10 Ant and bug on a stick

An ant and a bug walk along straight sticks. The solid graph illustrates the ant's position vs. time. The dashed graph indicates the bug's position vs. time. For the bug, and separately for the ant, which of the following is true during the period from $0s$ to $4s$?



i) Acceleration is zero at all times.

ii) Acceleration is positive at all times.

iii) Acceleration is negative at all times.

iv) Acceleration is first positive and later negative.

v) Acceleration is first negative and later positive.